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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,221	05/20/2004	Kazuaki Inukai	403085	6822

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EXAMINER

EVERHART, CARIDAD

ART UNIT PAPER NUMBER

2891

DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary

Application No.

10/849,221

Applicant(s)

INUKAI ET AL.

Examiner

Caridad M. Everhart

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 8-17-08
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1,2,10,15,and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Chooi, et al. (US 6,372,636B1).

Chooi, et al disclose the steps of forming a stopper film over a semiconductor substrate which has a conductive layer therein(Fig. 2a shows conductive layer 210, stopper film 225, described in col. 7, lines 12-16 and 36-40). There is further formed layer 230, which is a low-k dielectric layer(col. 7, lines 41-45), and cap layer 235 which is silicon oxide or silicon nitride or silicon carbide(col.7, lines 50-52). A photoresist layer is formed(col. 7, lines 52-55), and a hole is etched using the photoresist as a mask(col. 7, lines 55-65) and a portion of the etch-stop is removed. The photoresist is removed by ashing(col. 8,lines 5-10). A barrier film is formed (col. 8, lines 61-67) and copper is deposited to fill the openings(col. 9, lines 19-24). The dielectric may be spin-on-glass(col.7, lines 45-46), wherein the disclosure that the dielectric may be SiO₂ deposited by spin coating is interpreted to disclose that the layer may be SOG.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 9 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi et al in view of Han, et al. (US 6,424,044B1).

Chooi et al is silent with respect to the material of the etch-stop layer.

Han, et al disclose that silicon nitride is conventionally used as an etch-stop layer(col. 2,lines 45-50).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used silicon nitride as the etch stop layer in the method taught by

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Chooi et al because Han teaches that this material is conventional in the art for an etch stop layer and because one of ordinary skill in the art would have been able to choose this material based on the etch properties of silicon nitride being different from those of the low-k dielectric layers, which is also a reason that silicon nitride is conventional in the art for etch stop layers.

Claims 3, 4, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi, et al in view of Chien, et al (US 6,426,304B1).

Chooi, et al does not teach the mixture of hydrogen and inert gas nor the temperatures for the photoresist ashing recited in the claims.

Chien, et al discloses hydrogen and nitrogen photoresist stripping(col. 5,lines 12-25). The percentage of hydrogen with respect to inert gas includes the recited range(col. 6, lines 18-22). Chien, et al teach also that the temperature can be optimized (col. 6, lines 43-45).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the ashing gases taught by Chien, et al in the process taught by Chooi, et al in order to avoid damaging the low-k dielectric materials(Chien, et al , col. 3,lines 1-4).

With respect to the temperatures, this would have been obvious to one of ordinary skill in the art to determine because the temperature is a variable of the art, and in addition Chien et al teach controlling the temperature with backside wafer cooling(col. 6,lines 31-40), although Chien et al is silent with respect to the temperature at which the

ashing takes place, Chien et al teaches that the temperature can be optimized(col. 6,lines 43-45).

Claims 5, 6, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi et al in view of Chien et al as applied to claims 3, 4, 11, and 12 above, and further in view of Ranft, et al (US 6,536,449B1).

Chooi et al in view of Chien et al does not teach the recited noble gases.

Ranft, et al disclose the use of noble gases or nitrogen in the removal of photoresist from a substrate (col. 3, lines 55-67).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have used the gases taught by Ranft et al in the process taught by Chooi et al in view of Chien et al because Chien et al teach that alternative diluents other than nitrogen may be used (col. 5, lines 15-25).

Claims 8 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chooi, et al in view of Chang, et al (US 6,319,850B1).

Chooi et al is silent with respect to the film being porous, although Chooi et al does teach fluorinated silicon oxide(col. 7, lines 44-45).

Chang, et al teaches that fluorinated silicon oxide in which there is an anneal step results in a low-k fluorinated silicon oxide film which is made low-k by being made porous(col. 2,lines 51-54).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the fluorinated silicon oxide film taught by Chooi et al to be

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made porous as taught by Chang, et al because Chooi et al teach a low-k film, and because Chooi et al also teach anneal step as taught by Chang, et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C. Everhart
4-20-2005


CARIDAD EVERHART
PRIMARY EXAMINER